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ABSTRACT

The 1983 report, "A Nation at Risk," left education researchers with the important question of how much student achievement, for youth who stay in school, grows during different stages of schooling. Data are available to answer this question for high school students, and the same data source, the National Education Longitudinal Study of 1988 (NELS:88), makes it possible to examine differences in achievement for Blacks, Whites, and Hispanic Americans. Data from the NELS:88 for students near the end of 8th and 12th grades make it apparent that very modest gains in achievement occur over the high school years compared to the range of achievement existing near the end of grade 8. Whites students score higher than Blacks and Hispanics at the end of eighth grade, and these differences do not increase substantially over the next 4 years. All of the significant differences in reading and mathematics achievement between White, Black, and Hispanic students at the end of 12th grade reflect differences that already existed before they entered high school. Both reading and mathematics achievement do increase from grade 8 to grade 12, with most of the increase occurring before grade 10. These changes are overall changes in the achievement distributions at each grade, and not the achievement gains of groups, such as Blacks and Hispanics compared to Whites. Achievement of 12th graders as a group is not dissimilar to that of 8th graders as a group. In addition, data indicate that the high school years do not contribute significantly to racial and ethnic differences in reading and mathematics achievement. (Contains five tables and three references.) (SLD)

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ISSUE BRIEF:

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ISSUE BRIEF

Reading and Mathematics Achievement: Growth in High School

December 1997

The most recent wave of concern over the level of academic achievement among our nation's school population began with the publication of *A Nation at Risk* in 1983. The report left education researchers with an important question: How much does student achievement (for youth who stay in school) grow during different stages of students' schooling? To answer the question for the high school years, data are available describing the academic achievement of high school students between 8th and 12th grades in reading and mathematics. It also is important to examine differences between whites, blacks, and Hispanics in reading and mathematics achievement over these same years.

Data from the *National Education Longitudinal Study of 1988* on reading and mathematics achievement of students near the end of 8th and 12th grades reveal that:

- Very modest gains in achievement occur over the high school years compared to the range of achievement existing near the end of eighth grade.
- White students score higher in both reading and mathematics than black and Hispanic students at the end of the eighth grade. These differences do not increase substantively over the next four years.
- All of the significant differences in reading and mathematics achievement between whites and black and Hispanic minority groups at the end of 12th grade reflect differences in achievement between the groups before they enter high school.

Overall Achievement Growth

Both reading and mathematics achievement increase from the spring of grade 8 to the spring of grade 12 (table 1). The gains from the spring of grade 8 to the spring of grade 10 are larger than the gains from the spring of grade 10 to the spring of grade 12. The average yearly gain over all four years of high school is 0.17 eighth-grade standard deviations in reading and 0.26 eighth-grade standard deviations in mathematics. These yearly gains are similar in magnitude to those reported for the *High School and Beyond* survey (Alexander, Natriello, & Pallas 1985) and to those reported in a number of other studies summarized by Jencks (1985).

Table 1.—Achievement in grades 8–12

	Subject and grade					
	Reading			Mathematics		
IRT scores*	8	10	12	8	10	12
Mean	28.5	32.3	34.4	38.1	46.0	50.5
Standard deviations	8.4	9.6	9.7	11.6	13.1	13.7
IRT score gains*	8–10	10–12	8–12	8–10	10–12	8–12
Gains	3.7	2.2	5.9	7.9	4.4	12.3
Gains per year in 8th grade standard deviations	0.22	0.13	0.17	0.34	0.19	0.26

*Number correct scores on tests equated across grades 8, 10, and 12 with item response theory (IRT).

SOURCE: *National Education Longitudinal Study of 1988.* See Ingels, et. al. (1994).

One way to interpret the size of these gains is to convert 8th-, 10th-, and 12th-grade achievement scores into their percentile equivalents among 8th-graders (table 2). Twelfth-graders have mean 12th-grade reading scores equal to 8th-graders at the 68th percentile and mean mathematics scores equal to 8th-graders at the 75th percentile. The average student thus gains 4.5 8th-grade percentiles per year in reading and 6.2 8th-grade percentiles per year in mathematics.

Table 2.—Average reading and mathematics achievement in grades 8–12 in eighth-grade percentiles

	Subject and grade					
	Reading			Mathematics		
8th-grade percentiles	8	10	12	8	10	12
Mean	50.6	61.9	68.4	50.5	67.6	75.3
Gains in 8th-grade percentiles	8–10	10–12	8–12	8–10	10–12	8–12
Yearly gain	5.7	3.3	4.5	8.6	3.9	6.2

SOURCE: *National Education Longitudinal Study of 1988.* See Ingels, et. al. (1994).

Many 8th-graders' scores are higher than those of the average 12th-grader, and many 12th-graders' scores are below those of the average 8th-grader. Table 3 shows the percentage of students at each grade level with achievement scores in each quarter of the eighth-grade distribution. About 28 percent of 12th-graders have scores that would put them in the bottom half of 8th-graders in reading, and about 20 percent of 12th-graders have mathematics scores in the bottom half of the 8th-grade distribution. These results suggest considerable overlap in the achievement distributions of 8th-, 10th-, and 12th-graders.

Table 3.—Percentage of students in grades 8, 10, and 12 with achievement scores falling in each quarter of the 8th-grade distribution

	Subject and grade					
Percent in each	Reading			Mathematics		
8th-grade quartile	8	10	12	8	10	12
0–25	24.9	18.2	13.4	24.9	12.3	7.2
26–50	25.2	18.3	14.9	25.2	15.5	12.4
51–75	25.0	20.2	18.8	25.0	23.0	19.5
76–100	24.9	43.3	52.8	24.9	49.2	60.9

SOURCE: *National Education Longitudinal Study of 1988.* See Ingels, et. al. (1994).

Overall, these results show that achievement increases over the high school years, but that the gains are relatively modest compared to the range of variation in eighth grade. It is important to note that these results describe overall changes in the achievement distributions at each grade, and not the achievement gains of groups, such as blacks and Hispanics compared to whites.

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Race/ethnicity and Achievement Gains

On average, blacks and Hispanics score lower than whites in reading and mathematics at the end of 8th grade (table 4, row 1) and at the end of 12th grade (row 2). The black and Hispanic differences from whites at the end of 12th grade are statistically the same size as at the end of 8th grade (row 2 compared to row 1). These results suggest that the reading and mathematics achievement differences between white students and minority black and Hispanic students do not increase over the high school years.

Table 4.—Black–white and Hispanic–white differences in 8th and 12th grade reading and mathematics achievement[1]

	Race difference and subject			
	Black-white		Hispanic-white	
	Reading	Math	Reading	Math
1. Eighth-grade differences	-52[2]	-90[2]	-42[2]	-64[2]
2. Twelfth-grade differences	-61[2]	-103[2]	-41[2]	-64[2]
3. Twelfth-grade differences among students with the same eighth-grade scores	-0.8	-1.3	0.1	0.2

[1]Number correct scores on tests equated across grades 8, 10, and 12 with item response theory (IRT).

[2]$p<0.01$.

SOURCE: *National Education Longitudinal Study of 1988*. See Ingels, et. al. (1994).

While these results tell us that the race/ethnicity gap in reading and mathematics achievement at the end of 12th grade is no different statistically than at the end of 8th grade, they do not tell us how much of a race/ethnicity gap would exist at 12th grade among white, black, and Hispanic students with the same 8th grade achievement. The 12th-grade race/ethnicity gap reflects the fact that, on average, black and Hispanic students enter high school with different achievement levels than whites; that is, because the race/ethnicity gap exists at the end of 8th grade. Among students with the same 8th-grade achievement, the black and the Hispanic disadvantages in 12th-grade reading and mathematics vanish statistically (row 3).

Thus, the racial disparities in 12th-grade achievement reflect differences in achievement prior to entering high school. These results suggest that if blacks and Hispanics entered high school with the same achievement levels as whites, their differences from whites in 12th-grade reading and mathematics achievement would be extremely small and statistically insignificant.

Table 5 shows the race/ethnicity differences from table 4 divided by the average yearly growth in achievement scores from the end of grade 8 through grade 12. More intuitively, table 5 shows the number of years apart the race/ethnicity groups are in terms of achievement growth. At the end of the 12th grade, blacks are about 3–4 years of achievement growth behind whites, and Hispanics are about 2–3 years behind whites (line 1). Among students with the same 8th-grade achievement, however, the 12th-grade race/ethnicity differences after four years of high school are a half a year or less and are statistically insignificant (line 2).

Table 5.—Race/ethnicity differences at the end of 12th grade divided by average yearly growth from end of 8th grade to end of 12th grade

	Race difference and subject			
	Black-white		Hispanic-white	
	Reading	Math	Reading	Math
1. End of twelfth grade for all students	-4.2	-3.3	-2.8	-2.1
2. End of twelfth grade for students with the same eighth grade test scores	-0.5	-0.4	0.1	0.1

SOURCE: *National Education Longitudinal Study of 1988*. See Ingels, et. al. (1994).

Conclusions

Overall, data from the *National Education Longitudinal Study of 1988* support two conclusions. The first is that without regard to students' race or ethnicity, achievement growth over the high school years in reading and mathematics is relatively modest compared to the range of achievement that exists at the beginning of high school. Achievement of 12th-graders as a group is not dissimilar to the achievement of 8th-graders.

The second conclusion is that the high school years do not contribute significantly to race/ethnicity differences in reading and mathematics achievement. Despite differences in the high schools attended by black, Hispanic, and white students, the 12th-grade reading and mathematics achievement differences between these groups reflects differences in how much they knew when they entered high school, and not on their race or ethnicity per se.

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